Global microscopic models for nuclear reaction calculations

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Important effort has been devoted in the last decades to measure reaction cross sections. Despite such effort, many nuclear applications still require the use of theoretical predictions to estimate experimentally unknown cross sections. Most of the nuclear ingredients in the calculations of reaction cross sections need to be extrapolated in an energy or/and mass domain out of reach of laboratory simulations. In addition, some applications often involve a large number of unstable nuclei, so that only global approaches can be used. For these reasons, when the nuclear ingredients to the reaction models cannot be determined from experimental data, it is highly recommended to consider preferentially microscopic or semi-microscopic global predictions based on sound and reliable nuclear models which, in turn, can compete with more phenomenological highly-parametrized models in the reproduction of experimental data.

The latest developments made in deriving such microscopic models for practical applications are reviewed. It mainly concerns nuclear structure properties (masses, deformations, radii, etc...), nuclear level densities, γ-ray strength functions as well as fission barriers and level densities at the fission saddle points. For each of these quantities, the microscopic predictions are compared with more phenomenological approaches, as those recommended by the IAEA database known as the Reference Input Parameter Library (RIPL). The impact of such microscopic nuclear inputs on capture cross sections is also discussed.

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